

Attorney Docket No. 10040097-1

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Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- 1 1. (original) A method of forming an integrated circuit package having a
2 sensor with imaging capability comprising:
3 connecting components to a single-piece substrate, including
4 fixing an integrated circuit die to a first area of said single-piece substrate
5 and fixing a light source to a second area of said single-piece substrate, said
6 integrated circuit die having said sensor; and
7 enclosing said components to define said integrated circuit
8 package having exposed input/output connections and having a window
9 optically aligned with said sensor;
10 wherein said first and second areas of said single-piece
11 substrate are at an angle to each other within said integrated circuit package,
12 such that an axis of light from said light source is non-parallel to an imaging
13 axis of said sensor and such that said light source illuminates a field of view of
14 said sensor.
- 1 2. (original) The method of claim 1 wherein said single-piece substrate is a
2 lead frame, said fixing of said integrated circuit die including using die attach
3 techniques.
- 1 3. (original) The method of claim 2 wherein connecting said components
2 includes attaching said integrated circuit die and said light source to said lead
3 frame while said lead frame is substantially flat, said enclosing including
4 bending said lead frame to establish said angle of said first area to said
5 second area.

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1 4. (original) The method of claim 3 further comprising forming an electrically
2 insulative material on opposite sides of said lead frame prior to connecting
3 said components, thereby defining a package form, said package form being
4 patterned to include a locking mechanism, said bending of said lead frame
5 including utilizing said locking mechanism to fix said lead frame in a position
6 to establish said angle.

1 5. (original) The method of claim 4 wherein defining said package form
2 includes fabricating separate first and second portions on said lead frame,
3 said first and second portions having cooperative structural features which
4 define said locking mechanism.

1 6. (original) The method of claim 1 further comprising patterning electrically
2 insulative material onto opposite sides of said one-piece substrate to define a
3 package form in which said first and second areas of said one-piece substrate
4 are fixed at said angle.

1 7. (original) The method of claim 6 wherein said one-piece substrate is a
2 lead frame, said patterning including enabling input/output connections to
3 remain exposed at an exterior of said package form.

1 8. (original) The method of claim 6 wherein connecting said components
2 includes using die attach techniques to connect said integrated circuit die and
3 light source in separate passes of said lead frame through a fabrication line.

1 9. (original) The method of claim 1 wherein connecting said components
2 includes providing said Integrated circuit die to include a matrix of pixel
3 elements and to include digital signal processing circuitry, said angle being
4 selected to establish a light-source-to-sensor relationship in which light from
5 said light source illuminates a surface being imaged by said matrix of pixel
6 elements, said matrix of pixel elements being said sensor.

1 10. (original) The method of claim 9 wherein enclosing said components
2 includes attaching a lens system for directing said light from said light source
3 and for collecting light reflected from said surface toward said matrix of pixel
4 elements, thereby providing a module for electrical and mechanical
5 connection within an electronic device.

1 11. (original) The method of claim 10 wherein connecting said components
2 includes providing said integrated circuit die such that said digital signal
3 processing circuitry is dedicated to generating navigation information specific
4 to movement of said sensor relative to said surface being illuminated by said
5 light source.

1 12.-16. (cancelled)

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- 1 17. (original) A method of forming an integrated circuit package comprising:
2 providing a generally flat lead frame having spaced apart
3 first and second areas for receiving components and having a plurality of
4 input/output conductors;
5 forming a first package portion about said first area of said
6 lead frame;
7 forming a second package portion about said second area of
8 said lead frame;
9 fixing a sensor die to said first area, including electrically
10 connecting said sensor die to at least some of said input/output conductors;
11 fixing a light source to said second area, including electrically
12 connecting said light source to at least one of said sensor die and said
13 input/output conductors; and
14 bending said lead frame in a region between said first and
15 second areas to establish a condition in which light from said light source
16 illuminates a field of view of said sensor die.
- 1 18. (original) The method of claim 17 further comprising securing said lead
2 frame in said condition using physical features of said first and second
3 package portions, wherein said first and second package portions are formed
4 using molding techniques.
- 1 19. (original) The method of claim 17 wherein fixing said sensor die includes
2 using die attach and wire bonding techniques for a device having a matrix of
3 pixel elements and circuitry dedicated to determining navigation information.

1 20. (original) The method of claim 17 further comprising attaching a lid to
2 said first and second package portions after said bending, said lid including a
3 lens system for directing said light from said light source and collecting light
4 for said sensor die, wherein attachment of said lid forms a module for
5 connection within an electronic device.

1 21. (original) A method of forming an integrated circuit package comprising:
2 fabricating a lead frame having a plurality of input/output
3 conductors, said lead frame having spaced apart first and second areas for
4 receiving components;
5 forming a package body of electrically insulative material on
6 said lead frame such that said first and second areas are at a selected angle
7 with respect to each other;
8 fixing a sensor die to said first area, including electrically
9 connecting said sensor die to at least some of said input/output conductors;
10 and
11 fixing a light source to said second area, including connecting
12 said light source to at least one of said sensor die and said input/output
13 conductors;
14 wherein said selected angle is such that a condition is
15 established in which light from said light source illuminates a field of view of
16 said sensor die.

1 22. (original) The method of claim 21 wherein fixing said sensor die includes
2 using die attach and wire bonding techniques for a device having a matrix of
3 pixel elements and circuitry dedicated to determining navigation information.

1 23. (original) The method of claim 21 further comprising attaching a lid to
2 said package body, said lid including a lens system for directing said light
3 from said light source and collecting light for said sensor die, wherein
4 attachment of said lid forms a module for connection within an electronic
5 device.

1 24. (original) The method of claim 21 wherein fixing said sensor die includes
2 using die attach and wire bond techniques for a die having a matrix of pixel
3 elements and circuitry dedicated to determining navigation information on the
4 basis of image information from said matrix.